



Minding the Gap Between Awareness and Behavior: Roles of Mindfulness and Connectedness to Nature in Fostering Ecological Behavior

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Minding the Gap Between Awareness and Behavior: Roles of Mindfulness and
Connectedness to Nature in Fostering Ecological Behavior

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A Thesis in the Field of Psychology
for the Degree of Master of Liberal Arts in Extension Studies

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Abstract

This study examined the interrelations among mindfulness, connectedness with nature, and ecologically sustainable behavior (ESB). Participants ($N = 149$), recruited online using Amazon Mechanical Turk, completed self-report questionnaires. Mindfulness represents a sociocognitive construct developed by Langer (1992), defined as “a state of openness to novelty in which the individual actively constructs categories and distinctions.” There is emerging empirical evidence linking Eastern tradition meditation-based mindfulness and connectedness with nature to ESB. However, only one published study has investigated the association among these three constructs. Further, Langer’s sociocognitive mindfulness construct, originating from scientific research and not requiring meditation, has not been examined in relation to either ESB or connectedness with nature. Because her mindfulness state can be achieved in shorter time without regular practice, it may be employed to enhance programs designed to foster ecological behavior among the public. Key findings were that, after controlling for demographic variables, mindfulness is a significant predictor of ESB (Hypothesis 1) and that there is a positive relationship between mindfulness and connectedness with nature (Hypothesis 2). Further, mindfulness and connectedness with nature each provide unique predictions of ESB and collectively they predict ESB better than either alone (Hypothesis 3). Analysis of relations among mindfulness subcategories (Flexibility, Novelty Seeking, Novelty Producing, Engagement), connectedness to nature, and ESB provided support for Hypothesis 4 in that Novelty Seeking has the strongest relationship with ESB, but not

Hypothesis 5 in that Engagement has the strongest relationship with connectedness to nature. Exploratory data analysis showed that both connectedness with nature and mindfulness have the strongest associations with Vicarious and Social Behaviors Toward Conservation in the ESB behavioral domain. Finally, demographic data analysis revealed between-sex differences in the main study variables and their relationships.

Dedication

I dedicate this thesis to my husband Runar Andersen for his endless encouragement, love and support, and to the memories of our son Aleksander who left us so suddenly half-way during this thesis process, but whose memories inspired me not to give up and to push forward. I hope you are proud of mama baby!

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Chapter I

Introduction

Excessive consumption and the resulting waste prevalent in Western countries damage our natural environment and disturb the ecological systems on which economies, societies, and life on Earth critically depend. These behaviors not only destroy our planet but also affect our health and threaten our survival as a human race (e.g., Leonard, 2009; Starke, 2012; Worldwatch Institute, 2013). According to 2012 data, the average American uses 194 pounds of natural resources and produces about 4.4 pounds of trash daily (U.S. Environmental Protection Agency, 2014). Environmental campaigns undertaken by governments and environmental organizations worldwide are trying to curb the environmental destruction. However, evidence has suggested that environmental policies and technological advances are not sufficient to make substantial positive changes and that individual involvement in ecologically sustainable behavior (ESB) is of crucial importance for our wellbeing and for the survival of our planet (Ericson, Kjønstad, & Barstad, 2014; Gardner & Stern, 2008; Leiserowitz, 2004; Marchand & Walker, 2008; Steg & Vlek, 2009; Steg, Bolderdijk, Keizer, & Perlaviciute, 2014).

Ecologically Sustainable Behavior

Ecologically Sustainable Behavior (ESB), which is also known as pro-environmental behavior or simply ecological behavior, “refers to behavior that harms the environment as little as possible, or even benefits the environment” (Steg & Vlek, 2009, p. 309). Such behavior changes the availability of materials and energy from the

environment and/or alters the structure of ecosystems. Among other actions, it includes buying products that have the least environmental impact, reducing consumption, recycling, using fewer energy resources, and switching to green means of transportation. Sustainability is seen as “meeting the needs of human beings alive today while trying to preserve conditions that allow future generations to meet their needs” (Worldwatch Institute, 2013, p. 18). Despite substantial research on sustainability that identified multiple social and personal factors resulting in pro-environmental behavior or a lack thereof (e.g., Bamberg & Möser, 2007; Gifford & Nilsson, 2014), ecological problems continue to worsen. Thus, new approaches are needed to promote individual involvement in ESB. The purpose of this study is to investigate roles of Langer mindfulness and connectedness to nature in predicting ecologically sustainable behavior.

Mindfulness

Mindfulness is rooted in ancient Eastern philosophy. It is a state of being attentive to and aware of what is taking place in the present moment (Brown & Ryan, 2003). A state of mindfulness is traditionally achieved by the systematic practicing of various meditation techniques originating from Buddhist traditions (Nhất Hạnh, 1987). In contrast, the present study employs a sociocognitive mindfulness construct not involving meditation developed by Langer (1992). Her mindfulness is achieved by actively looking for and noticing new things about familiar situations or stimuli and by actively constructing new categories, while paying attention to the situation and context. In numerous studies, Langer and her colleagues have demonstrated that simple interventions such as asking people to think of alternative uses for familiar objects (Alexander, Langer, Newman, Chandler, & David, 1989), presenting information in conditional rather than

rigid terms (Langer & Piper, 1987), and presenting personally relevant information (Chanowitz & Langer, 1981) lead to a mindful processing of information.

For example, Alexander et al. (1989) successfully implemented a 20-minute mindfulness training that involved two word-production exercises in which new words (not previously used in the same training session) were generated continuously for 6 minutes, by thinking of a random word and then finding a new word beginning with the last letter of the previous word. Between the two exercises, participants were asked to think of unusual uses for common objects or to argue a controversial topic against one's own previously established opinion. The results produced by this mindfulness intervention were comparable to those achieved with transcendental meditation.

Further, Langer has posited that the intentional process of drawing new distinctions directs our attention toward our experiences in the present (Langer & Moldoveanu, 2000), resulting in (a) openness to new information, (b) sensitivity to context, (c) awareness of multiple perspectives, and (d) continuous creation of new categories. Openness to new information refers to receptivity to signals from our constantly changing environment. It is the awareness that our knowledge is limited and an ability to develop new ways of thinking (Pistorello, 2013). Sensitivity to context is an ability to process information within a given context. That is, it is the awareness that information may have different meanings in different settings or under different circumstances. Awareness of multiple perspectives is the realization that there is more than one point of view and that there can be as many points of view as there are different observers (Langer, 1989). Continuous creation of new categories refers to active re-categorizing and re-labeling familiar things depending on the context and situation as opposed to relying on labels and categories created in the past (Langer, 1989).

This mindfulness construct combines attributes of multiple psychological constructs (Sternberg, 2000). That is, openness to new information may be related to the “openness to new experiences” personality trait while awareness of multiple perspectives and sensitivity to context may be related to cognitive abilities. Langer (1989) has stated that most of us are mindless most of the time and that the mindfulness state can be achieved through active cognitive involvement with our environment. This implies that mindfulness is more a mental state or a preferred way of using one’s cognitive abilities rather than a fixed personality trait or a cognitive ability (Sternberg, 2000).

The two main characteristics that distinguish Langer’s sociocognitive mindfulness approach from the generally accepted operational definition of mindfulness are: (1) it is not achieved through meditation practice but through the creation of new categories and meanings; and (2) it focuses on paying attention to external stimuli, such as context or a situation, as opposed to one’s internal thoughts and emotions (Bishop et al., 2004). These differences have suggested that Langer’s mindfulness concept may be more applicable than the generally accepted definition for fostering ESB in the general population. First, meditation practices are not common in Western countries. Based on the National Health Interview Survey (NHIS) with cross-sectional data from a combined sample of 88,962 adults aged 18 years and over, only 7.6%, 9.4 % and 8% of the U.S. adults have reported practicing meditation on a regular basis in 2002, 2007 and 2012 respectively (Clarke, Black, Stussman, Barnes, & Nahin, 2015). However most people have an ability to notice things intentionally and to create new meanings and categories when prompted to do so; this ability allows us to learn and make sense about the world beginning in childhood (Langer, 1989). As a result, Langer’s mindfulness theory has been successfully applied in a wide range of life settings such as education and healthcare settings (Langer, 1992,

1997; Langer & Moldoveanu, 2000). For example, it has been used to achieve better learning outcomes among university students (Langer, 1997), to improve health and longevity among nursing home patients (Alexander et al., 1989; Langer, 1992), and to boost creativity and improve engagement at work (Langer, 1989). Second, because ecologically sustainable behavior involves interaction with the environment, bringing attention to external stimuli may be more effective for fostering ESB than bringing attention to internal states and thoughts as in the traditional mindfulness approach.

Mindfulness and Ecologically Sustainable Behavior

Even though no research to date has investigated the relationship between Langer's mindfulness construct and ecologically sustainable behavior, emerging empirical evidence has demonstrated a relationship between mindfulness based on Eastern traditions and ESB (Amel, Manning, & Scott, 2009; Barber & Deale, 2014; Ericson et al., 2014; Kaplan, 2010; Nisbet & Zelenski, 2013). Brown and Kasser (2005) tested a hypothesis that a higher level of both ESB and subjective well-being is related to a relative intrinsic (non-materialistic) value orientation, greater mindfulness, and voluntary simplicity (VS) in a sample of 400 US adults. Subjective Well-Being (SWB) measures frequency of both positive affect and negative affect, and a global sense of general life satisfaction (Myers & Diener, 1995). Intrinsic values represent personal values oriented toward relationships, personal growth, and community while extrinsic values represent personal values focusing on financial success, self-image, and popularity (Brown & Kasser, 2005). The sample consisted of two groups: 200 self-identified *voluntary simplicity* participants and 200 *mainstream* participants. Kasser and Brown (2005) defined voluntary simplicity as a voluntary reduction in both income, and

consumption spending despite having a higher education and an ability to earn more.

The participants answered pencil-and-paper questionnaires: the 15-item Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) used to assess attention to and awareness of ongoing internal and external events and experiences; and two tasks assessing ecological behavior, namely, the 12-item Ecological Footprint Questionnaire (EFQ; Dholokia & Wackernagel, 1999), measuring input on the individual level by assessing diet, housing and transportation choices; and the 5-point Ecological Behavior Scale (EBS; Brown & Kasser, 2005) assessing the proportion of time people engage in 54 positive environmental behaviors. In addition, intrinsic value orientation was measured using the 30-item Aspiration Index (AI; Kasser & Ryan, 1996) with higher values on a 5-point scale representing less materialistic orientation. Structural equation modeling revealed that mindfulness was a significant predictor of ecologically sustainable behavior. There was also a positive association between mindfulness and the Ecological Foot Print (EFQ) measure, and mindfulness and the environmental behavior (EBS) measure (Brown & Kasser, 2005).

In another study, Jacob, Jovic, and Brinkerhoff (2009) examined the relationship between mindfulness and ESB in 829 members of Buddhist Peace Fellowship, a spiritual organization in California encouraging mindfulness meditation practice, activism, and earth-friendly behavior. The majority of respondents were middle-aged moderately affluent adults, with 79.5% of the participants practicing meditation at least once a week. They were mailed pencil and paper questionnaires to assess their involvement in ESB, the frequency of their meditation practices and their spirituality. To assess ESB, the authors developed a scale from a variety of environmental sources; The scale contained 12 items grouped in three categories (*recycling, sustainable household choices, and sustainable*

food practices). Mindfulness was measured by the number of days per week a respondent meditated. The study revealed that more frequent practice of meditation was associated with more self-reported sustainable household choices, and food practices.

Collectively, the previous findings indicated that sociocognitive mindfulness may predict ESB because there are many common characteristics between mindfulness constructs that have been linked to ESB and Langer's mindfulness. For example, both mindfulness achieved through meditation and sociocognitive mindfulness are characterized by heightened attention, sensitivity, openness and curiosity (Bishop et al., 2004; Langer, 2000; Langer & Moldoveanu, 2000; Sternberg, 2000). Both mindfulness concepts have also been linked to reduced automatic behavior and improved information processing (Langer, 1989).

Problem awareness, personal values, attitudes, and social norms have also been included among major factors that drive sustainable behavior (Bamberg & Möser, 2007; Hurst, Dittmar, Bond, & Kasser, 2013). However, because people are often mindless or act on "autopilot" (Langer, 1989), habitually repeating past behaviors with little regard to current goals and environmental outcomes (Wood & Neal, 2009), making behavioral changes through raising awareness or manipulation of values and attitudes is difficult (Ericson et al., 2014; Gifford & Nilsson). For example, a recent meta-analysis of 13 independent samples, that provided 11 correlations between materialistic values and environmental attitudes and 15 correlations between materialistic values and environmental behavior, suggested that, as environmental issues awareness have grown in recent years, people have developed greater environmental attitudes but have not changed their behavior (Hurst et al., 2013). Analysis of the moderating effect of year of publication (ranging from 1992 to 2010) revealed that the more recent the study, the less

negative was the relationship between materialism and environmental attitudes whereas the relationship between materialism and environmental behavior was not affected by year of publication (Hurst et al., 2013). This widening gap between attitudes and behavior can partially be explained by habits or automatic behaviors (Amel et al., 2009; Ericson et al., 2014; Gärling, 2014), which represent about 60% of our behavior (Duhigg, 2012).

Habits are defined as automatic, repeated actions that often happen outside of our awareness or by an unconscious mechanism that impacts the countless choices that seem as if they're the products of well-reasoned thought, but actually are influenced by urges most of us barely recognize or understand" (Duhigg, 2012, p. 7). Actions that we repeat often in our daily lives, such as making coffee or going grocery shopping, become habits or routines that we perform automatically, without paying attention to each step (Langer, 1989). For example, when we learn a new dance pattern, we think of every step, every turn, and every arm movement. Once we repeat the pattern many times, it becomes automatic. We no longer need mental resources to remember and execute each step. In fact, we often forget individual steps after they have been embedded into a memorized pattern or routine (Langer, 1989).

Once formed, habits are difficult to change, despite attitudes, values, beliefs, and motivations because they are automatic responses in a familiar context that exist outside of our awareness (Duhigg, 2012; Wood & Neal, 2009). For example, shoppers forget to bring reusable grocery bags to a supermarket despite their intention to do so because bringing a bag is not a part of their grocery shopping routine. In addition, as habits develop, alternative actions become less accessible (Wood & Neal, 2009). For instance, when we form a habit of purchasing a particular product or service, we are less likely to notice or switch to the emerging sustainable alternatives.

Sociocognitive mindfulness may lead to sustainable behavior through its ability to reduce automatic behavior and to improve processing of external stimuli (Langer, 1989; 1992; Langer & Moldoveanu, 2000). Awareness of context and multiple perspectives leads to actions that are governed by active cognitive processing rather than automatic responses (Langer, 1989, 1992; Langer & Moldoveanu, 2000). Because “habitual responses in memory are activated directly by context cues” (Wood & Neal, 2009, p. 580), being aware of context reduces automatic behavior (Langer, 1989). For example, most people have a habit of disposing of plastic “take away” containers, while buying similar containers for food storage. Becoming aware that the same plastic container may be considered as “take away” or “food storage” depending on the context, people might stop automatically disposing of take away containers and start using them for food storage.

According to Langer (1989), being mindful implies viewing familiar situations and tasks as new and performing familiar routines as if doing them for the first time through paying attention to each step of the process (Langer & Moldoveanu, 2000). Such mindful approaches to daily routines may lead to ESB because it would allow people to replace automatic actions with consciously chosen alternatives. For example, mindful grocery shopping may involve: (a) considering alternative places to shop such as a local farmers market; (b) considering items to bring to the store; (c) noticing and learning about new products available; and (d) purchasing products based on new information, such as facts about their environmental impact, rather than out of habit. Thus, a mindful approach to a familiar routine may mean remembering a reusable bag or purchasing new sustainable products.

Langer (1992) has suggested that mindfulness enables the individual to become aware of alternatives and take advantage of the opportunities of which the mindless individual is unaware. To behave in a sustainable way, people need to become aware of available sustainable alternatives first (Frick, Kaiser, & Wilson, 2004). To purchase a sustainable product, we at least need to notice that it exists. Looking for novelty in our environment may contribute to becoming aware of emerging sustainable alternatives and their qualities. Unlike the awareness of the environmental issues, knowledge about specific pro-environmental actions or products and their consequences for the environment is essential for cultivating ESB (Frick, Kaiser, & Wilson, 2004; Gardner & Stern, 2008; Marchand & Walker, 2008). Moreover, the more knowledge one has about a product, the more likely one is to purchase it (Gleim, Smith, Andrews, & Cronin, 2013). For example, a survey of 337 adults in a large metropolitan area in Brazil showed a strong relationship between information and knowledge about sustainable products and their consumption (Ritter, Borchardt, Vaccaro, Pereira, & Almeida, 2015).

There is also empirical evidence that intrinsic values orientation leads to ESB whereas there is a strong negative relationship between ESB and extrinsic values orientation (Brown & Kasser, 2005; Hurst et al., 2013). As defined earlier, intrinsic values represent non-materialistic personal values, oriented toward relationships, experiences, and personal growth as opposed to extrinsic or materialistic values focusing on financial success, image, and popularity (Brown & Kasser, 2005). For example, Hurst et al.'s (2013) meta-analysis of research linking materialistic values with environmental attitudes and behaviors, demonstrated that materialism was negatively associated with ESB, and that intrinsic values orientation was one of the significant predictors of ecologically sustainable behavior. Mindfulness may lead to ESB because mindfulness has

been linked to a reduction in materialism and an increase in intrinsic values orientation (Brown & Kasser, 2005; Ericson et al., 2014; Rosenberg, 2004).

Further, Rosenberg (2004) has argued that mindfulness can make us more resilient to persuasion by others. The input from our environment forms and reinforces the common belief that material possessions lead to happiness and well-being (Brown & Kasser, 2005; Gardner & Stern, 2008; Leonard, 2009). However, studies have also demonstrated that people who place more value on non-materialistic/intrinsic possessions such as personal relationships, community, and experiences are happier than materialistic people (Brown & Kasser, 2005; Kabat-Zinn, 2005; Kasser et al., 2014; Myers & Diener, 1995). Thus, mindfulness may result in less materialism because of improved processing of external stimuli such as advertisement and materialistic social norms that are deeply embedded in US culture. Because Langer's mindfulness "emphasizes active cognitive operations on perceptual inputs from the external environment, such as creation of new categories and seeking of multiple perspectives" (Brown & Ryan, 2003, p. 823), it may help people to re-evaluate social norms and advertisement messages, and "consider that they may be part of someone else's costly construction of reality" (Langer, 1989, p. 29). Having awareness of multiple perspectives may lead to the realization that buying additional items (e.g., new car, bigger house) does not benefit all. For example, from a perspective of a person who will have to accumulate more debt and work longer hours to pay for additional possessions, having less could lead to more life satisfaction. Processing input from our environment with an awareness of multiple perspectives on the sources of well-being as well as being able to create new categories to define well-being may lead to reduction in materialism and consequentially to ESB.

Mindfulness, Connectedness to Nature and Ecologically Sustainable Behavior

While mindfulness may lead to ESB through increased attention and active cognitive engagement with one's environment, connectedness to nature may increase motivation for ESB through reduced psychological distance between self and the environment (Frantz, Mayer, Norton, & Rock, 2005) and increased self-interest in protecting it (Nisbet, Zelenski, & Murphy, 2009). "Developing emotional connectedness to the natural world—to wild places, natural beauty, native plants, wildlife, and healthy ecosystems—is at least as important for protecting environment as breakthroughs in environmental science, policy, and management" (Worldwatch Institute, 2014, p. 42).

Relevant empirical evidence has suggested that people place more value on items to which they are emotionally attached to or to what they consider theirs (Cialdini, 1993). Thus, individuals may be less likely to harm the natural environment if they feel they are part of it so that damage to the environment comes to be seen as damage to the self (Nisbet et al., 2009) and, thus, there is self-interest in preserving it. Merchand and Walker (2008) have suggested that people engage in ESB not only because they understand the consequences of their behavior on the environment but also because they expect personal benefits from their actions. Based on a meta-analysis of 46 independent studies of ESB, Bamberg and Moser (2007) concluded that self-interest represents a strong motive for ESB.

Up to date research has demonstrated a significant relationship between connectedness to nature and pro-environmental behavior (Hoot & Friedman, 2011; Mayer & Frantz, 2004; Perkins, 2010; Restall & Conrad, 2015). However, there has been a lack of research examining relationships of connectedness to nature to both Langer mindfulness and ESB. In the only published study linking the three concepts, Barbaro

and Pickett (2015) investigated the effect of connectedness to nature on the relationship between mindfulness and engagement in ESB. They conducted two studies: one using 360 participants recruited from the Midwestern University Psychology Department study participation pool and a second employing 296 participants recruited through Amazon Mechanical Turk (MTurk). In both studies, participants completed three questionnaires: mindfulness was measured using the Five-Facets Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006), connectedness to nature was measured using a connectedness to nature scale (CNS; (Mayer & Frantz, 2004), and ESB was measured using a modified version of the Pro-Environmental Behavior scale (PEB; Whitmarsh & O'Neill, 2010). ESB was weakly correlated with mindfulness but showed a moderate correlation with connectedness to nature. Both studies have demonstrated that connectedness to nature mediates the relationship between mindfulness and ESB (Barbaro & Pickett, 2015).

There is also emerging empirical evidence demonstrating an association between connectedness to nature and mindfulness, however the findings have been mixed (Amel et al., 2009; Barbaro & Pickett, 2015; Howell, Dopko, Passmore, & Buro, 2011; Wolsko & Lindberg, 2103). Moreover, the research has been limited to mindfulness based on Eastern Buddhist traditions. Barbaro and Pickett (2015) reported a moderate correlation between connectedness to nature and mindfulness. These data have suggested that there are also may be a relationship between sociocognitive mindfulness and connectedness to nature because both mindfulness concepts are associated with heightened attention (Langer & Moldoveanu, 2000; Wolsko & Lindberg, 2103). Langer's mindfulness may also be associated with the connectedness state through its qualities of increased awareness of and sensitivity to one's environment. For example, Frantz et al. (2005)

demonstrated that switching focus from self to the environment is associated with connectedness to nature.

Connectedness to nature may lead to processing information about the consequences of one's actions on the environment as personally relevant. This type of information processing may result in a mindful state and increase in ESB. For example, Chanowitz and Langer (1981) demonstrated that people process only personally relevant information in a conscious mindful way; they are motivated to critically assess and use only personally relevant information. People may not actively process and therefore are not able to use the information about the impact of their behavior on the environment because they do not see this information as personally relevant. In line with this, studies have reported that environmental impact is most often the unintended consequence of a behavior that, from the person's point of view, has nothing to do with the environment (Hedlund-de Witt, de Boer, & Boersema, 2014). However, awareness of the consequences of one's actions on the environment is fundamental for promoting ESB because people use this knowledge for choosing from available behavioral alternatives (Frick, Kaiser, & Wilson, 2004; Kaiser, Doka, Hofstetter, & Ranney, 2003). Gardner and Stern (2008) reported that knowing what actions lead to best environmental outcomes brings rise to more sustainable behavior. Thus, connectedness to nature may increase both mindfulness and ESB through motivating people to become more aware of the consequences of their actions on the environment and to use this information for choosing their actions.

Connectedness to nature in combination with mindfulness may also reduce the perceived conflict between personal benefit and sustainable behavior. Because sustainable behavior is often perceived as making personal sacrifices to one's well-being

for the sake of the environment (Brown & Kasser, 2005; Ericson et al., 2014), most people are unwilling to make sustainable choices unless there is a self-benefit (Kaiser et al., 2003; McKenzie-Mohr, 2011). For example, people are more likely to save time or increase comfort by driving instead of biking because they do not immediately experience the benefit from clean air. Feeling connected with nature may increase the perception of self-benefit from ESB (Frantz et al., 2005) while mindful awareness of multiple perspectives on the consequences of one's actions may help to reframe ecological behavior from self-sacrifice to self-benefit. According to Kasser and Warren (2005), the less people perceive ESB as self-sacrifice, the more likely they are to make sustainable choices.

Study Aims and Hypotheses

The purpose of this study—which has one primary and three secondary aims—is to investigate relationships among sociocognitive mindfulness, the subjective feeling of connectedness to nature, and ecologically sustainable behavior. In addition, the relationships among subcategories of sociocognitive mindfulness and domains of pro-environmental behavior will be explored. Finally, demographic differences in the relationships among the main study variables (mindfulness, connectedness to nature, ESB) will be analyzed.

Aim 1

The primary aim of this study is to test three hypotheses. Hypothesis 1: Sociocognitive mindfulness is a significant predictor of pro-environmental behavior. Hypothesis 2: There is a positive relationship between sociocognitive mindfulness and

connectedness with nature. Hypothesis 3: Sociocognitive mindfulness and connectedness with nature each provide unique prediction of pro-environmental behavior, and together collectively they predict pro-environmental behavior better than each of these predictors does alone. These hypotheses were formulated based on the above literature review. Although there have been no studies investigating the relationships among Langer's sociocognitive concept of mindfulness, ecological behavior and connectedness to nature, the emerging research linking Eastern tradition mindfulness to connectedness to nature and to ESB provides support for these hypotheses.

Aim 2

The first secondary aim of this study is to examine relationships among mindfulness sub-scale factors (Flexibility, Novelty Seeking, Novelty Producing, Engagement), connectedness to nature and ESB to gain greater insight onto which mindfulness facets have most utility on connectedness to nature and ESB. Based on available research and description of mindfulness subcategories, I predict that Novelty Seeking will have the strongest relationship with ESB (Hypothesis 4) while Engagement will have the strongest relationship with connectedness to nature (Hypothesis 5). Novelty seeking may result in greater knowledge of environmental consequences of one's behavior and awareness of sustainable behavior alternatives. Such knowledge is a contingency for the sustainable behavior to occur (Frick et al., 2004; Gardner & Stern, 2008; Gleim et al., 2013; Marchand & Walker, 2008). Because engagement is associated with attending to a big picture and noticing changes in the surrounding environment (Pirson, Langer, Bodner, & Zilcha, 2013), this mindfulness subcategory may lead to

realizing the interdependence between human beings and the natural environment they inhabit.

Aim 3

The second secondary aim of this research is to analyze correlations between GEB domains (Energy Conservation, Mobility and Transportation, Waste Avoidance, Consumerism, Recycling, Vicarious and Social Behaviors Toward Conservation), mindfulness and its subscales, and connectedness to nature to learn what kind of ecological behaviors are predicted by the two independent variables. Due to the lack of research in this domain, no specific hypothesis has been formulated.

Aim 4

The third secondary aim is to investigate whether the relationships among mindfulness, connectedness to nature, and ecological behavior differ according to sex, race, marital status, education, and income. Due to lack of research examining moderating effects of demographic variables on the relationships among the main study variables, this is an exploratory analysis. No specific hypothesis has been formulated.

Study Significance

Despite substantial research on sustainability that have identified multiple social and personal factors resulting in pro-environmental behavior or lack thereof (Bamberg & Möser, 2007; Gifford & Nilsson, 2014), ecological problems continue to worsen. Thus, new approaches are needed to promote individual involvement in ESB. There is emerging empirical evidence suggesting strong associations among Eastern tradition

meditation-based mindfulness, feelings of connectedness to nature, and ecologically sustainable behavior (Amel et al., 2009; Barber & Deale, 2014; Jacob et al., 2009; Kaplan, 2010; Mayer & Frantz, 2004; Nisbet & Zelenski, 2013). However, the sociocognitive mindfulness construct (Langer, 1989, 1992; Langer & Moldoveanu, 2000), originating from Langer's scientific research, has not been assessed in relation to either sustainable behavior or connectedness to nature. Thus, the purpose of this study is to explore the relationships among ESB, Langer's mindfulness, and connectedness to nature in a sample of US adults. If the data support the primary hypotheses (i.e., mindfulness and connectedness with nature predict ESB and are correlated), Langer's mindfulness construct could be utilized to develop programs fostering ESB among the public because her mindfulness state can be achieved very quickly and without systematic meditation practice (Bishop et al., 2004). This mindfulness construct has been widely studied, tested, and successfully applied across several domains such as learning, work, and aging (Langer, 1989; 1992, 1997). Further, mindfulness interventions may be used to enhance subjective feelings of connectedness to nature that have been shown to be strongly associated with ecologically sustainable behavior. In addition, examination of the relationships among mindfulness subcategories and ecological behavior domains may help to gain more insight about the relationship between the two constructs and thus lead to developing specific mindfulness interventions for different types of ecological behavior. Finally, examining the effect of demographic factors on the relationships among study variables (mindfulness, connectedness to nature, ESB) may help tailor mindfulness interventions related to demographic characteristics and level of connectedness to nature. In sum, the findings from this study have the potential to lead to experimental research and specifically to developing environmental programs that would

effectively use Langer's mindfulness and connectedness to nature toward fostering pro-environmental behavior in general public.

Chapter II

Method

An on-line correlational investigation was conducted to examine the relationships among mindfulness, connectedness to nature, and pro-environmental behavior in a sample of the U.S. adults. Study participants were asked to complete on-line questionnaires administered via Qualtrics online service and the responses were used to estimate relationships among the three variables and their subcategories using a correlational design (See Figure 1). In the current study, independent variables are Mindfulness and Connectedness to Nature. The dependent variable is Ecologically Sustainable Behavior.

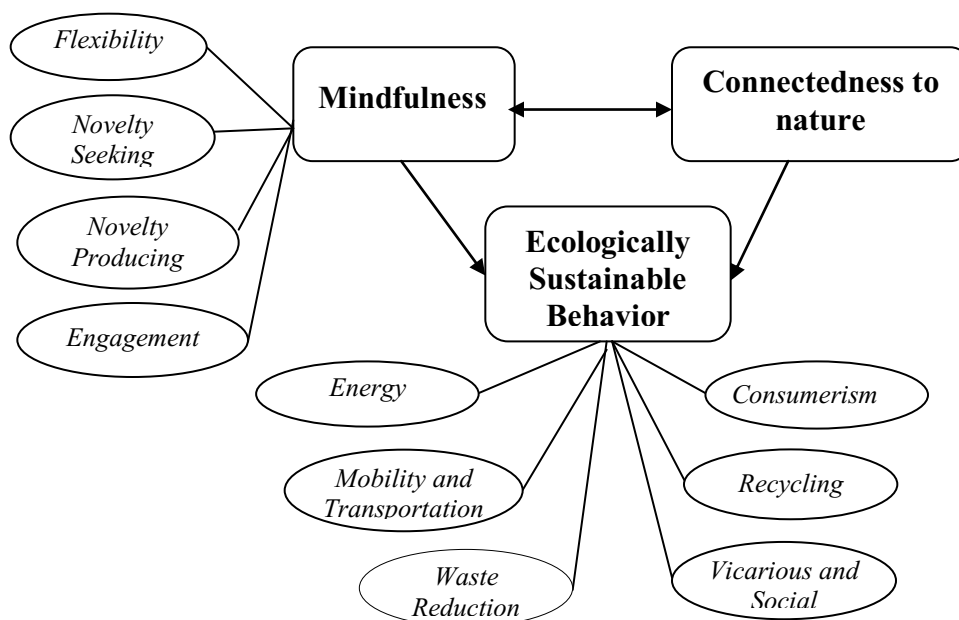


Figure 1. Hypothesized Relationships among Study Variables and Their Sub-categories. Dependent and independent variables are presented in boldface; sub-factors are presented in italic.

Participants

After having the research approved by the Harvard University Institutional Review Board (IRB), 164 participants were recruited using Amazon's MTurk (<https://www.mturk.com>). The recruitment took place over the two days, 12 – 13 November, 2016. The questionnaires estimated completion time was 15 minutes but the participants were allowed 3 hours to complete them. Compensation in the amount of \$2.00 was awarded to each participant who completed the study.

The inclusion criteria were that participants were US residents, at least 18-years-old, and fluent in English. Exclusion Criteria consisted of Amazon MTurk workers with lower than a 95% approval rating. MTurk limits workers younger than 18-year-olds and screens participants for workers' approval ratings automatically. The remaining exclusion criteria were part of the recruitment script in Amazon MTurk. The study also included "country of residence" question to verify that the residence inclusion criteria had been followed. No additional screening was possible due to the online study design.

Once all responses had been collected, the resulting dataset was cleaned to exclude the participants who did not complete all the parts of the questionnaire and who did not meet the inclusion criteria. In addition, the responses were screened for duplicate IP addresses, short response times, and inconsistent or fake response patterns. As a result of the data cleaning, 15 participants (9.0%) were excluded from the study (see Data Analysis). Of the remaining 149 participants, participants' reported age was: 10 (6.7%) were older adolescents/emerging adults (18-24 years), 49 (39.2%) were young adults (25-34 years), 35 (23.5%) were middle-aged adults (35-44 years), and 55 (36.9%) were older adults (44+ years). Both males and females were closely represented: 81 females (54.4%). See Table 1 for the demographic composition of the study sample.

Measures

The study protocol included measures to record differences in personality traits, in personal outlook, and in ecological behavior. Standard demographic questions were also included in the study: gender, age, marital status, education, race, income, employment status and country of residence.

Tasks and Measures

Langer Mindfulness Scale. Personal mindfulness level was measured with Langer Mindfulness Scale (LMS; Bodner & Langer, 2001). The scale (LMS) is 21-item 4-factor (flexibility, novelty seeking, novelty producing and engagement) self-report questionnaire designed to assess individual differences in mindfulness (Pirson, Langer, Bodner, & Zilcha, 2013). Novelty seeking is assessed by asking participants to which degree they agree or disagree with statements such as “I do not actively seek to learn new things,” while novelty producing is assessed with statements such as “I am very creative.” or “I generate few novel ideas.” Statements such as “I seldom notice what other people are up to” assess engagement. “I am always open to new ways of doing things” is an example of a flexibility statement. Higher scores indicate greater mindfulness. Ratings for each question range from 1 = *strongly disagree* to 7 = *strongly agree* with reverse scoring required on 8 of 21 items. Total test scores range from 21 to 147. Scoring for the scale and the subscales was provided by Langer’s lab upon completion of data collection (F. Pagnini, personal communication, May 31, 2016).

Pirson et al. (2013) tested the LMS with seven data samples toward establishing its reliability and construct validity. Across samples, internal consistency has been demonstrated with coefficient alphas reliability estimates of the entire scale ranging from

.83 to .90. Evidence for the scale's convergent validity was suggested by the correlation between the LMS and Mindfulness Attention and Awareness Scale (MAAS), the most frequently used scale based on the meditative understanding of mindfulness (Brown & Ryan, 2003). Across 4 of 7 samples, correlations ranged from .27 to .36 ($p < .01$). A negative relationship between LMS and the Personal Need for Structure scale was found with $r = -.24$; $p < .001$ and $r = -.33$, $p < .001$, for the two samples tested, representing evidence of the scale's discriminatory validity.

Connectedness to Nature Scale. Personal subjective feeling of connectedness to nature was assessed with the Connectedness to Nature Scale (CNS). The scale is 14-item questionnaire used to measure the extent to which people feel emotionally connected to the natural environment. Responses are rated from 1 = *strongly disagree* to 5 = *strongly agree* with higher scores indicating a greater feeling of connectedness to nature. Mean ratings from 1 to 5 serve as the measure in the analysis. The CNS scale asks participants to rate how connected they feel to the natural world with statements such as: "I often feel part of the web of life" or "I have a deep understanding of how my actions affect the natural world" ([see Appendix 3](#)). In five studies, Mayer and Stephan (2004) have demonstrated the scale's reliability and validity. The CNS scale has been shown to have a good internal consistency (Chronbach's $\alpha = .84$) and test-retest reliability ($r_{tt} = .78$, $p < .001$). Evidence of convergent validity is suggested by a strong correlation between CNS and new environmental paradigm (NEP) scale, which represents beliefs concerning one's connection to the natural world, $r = .52$, $p < .001$. The scale has also shown to possess the ability to predict sustainable behavior, $r = .44$, $p < .01$, environmentalism, $r = .61$, $p < .01$, and perspective taking, $r = .61$, $p < .01$.

General Ecological Behavior Scale. Personal involvement in ecologically sustainable behavior was measured using General Ecological Behavior (GEB) Scale, a self-report well-established measure of pro-environmental behavior (Kaiser & Wilson, 2004). It represents a general measure of ecological behavior and is not restricted to any particular context or culture or category of ecological behaviors (Kaiser & Wilson, 2000; Kaiser & Wilson, 2004). Higher scores indicate greater involvement in ecological behavior. The measurement scales consists of 50 behaviors divided into six performance domains: *energy conservation, vicarious social behaviors toward conservation, recycling, consumerism, waste avoidance, mobility and transportation* (see [Appendix 4](#)).

The latest version of the GEB scale consists of 32 polytomous and 18 dichotomous items (F. Kaiser, personal communication, November 11, 2016). The polytomous items measure frequency of behavior on a 5-point scale. The scale ranges from 1 (“Never”) to 5 (“Always”). The 18 dichotomous items are “Yes/No” questions that are scored with 1 and 0 respectively. The scoring is reversed for 16 items that represent unecological behaviors (see [Appendix 4](#)). After data collection, the polytomous items are converted to dichotomous; The questionnaire sum scores range from 0 to 50. The participants are asked to answer “Yes” or “No” to questions such as “In hotels I have towels changed daily” (energy conservation), “I am a member of a car pool” (mobility and transportation), and “I use fabric softener with my laundry” (consumerism). Questions such as “I collect and recycle used paper” (Recycling), “I boycott companies with an unecological background” (vicarious and social behaviors toward conservation), and “I buy milk in returnable bottles” waste avoidance) are polytomous. Kaiser and Wilson (2000) have demonstrated that the scale has both good internal consistency (Cronbach’s $\alpha = 0.72$) and good test-retest reliability ($r_{tt} = .76$).

Procedures

The study protocol included the following procedures: Data Collection, Data Cleaning, and Data Analysis.

Data Collection

Participants were recruited using Amazon MTurk, an on-line crowdsourcing service that has become increasingly popular for drawing respondents for social science studies. MTurk provides access to large and diverse groups of participants in a short time at a low cost. Data obtained with MTurk have been shown to be as reliable as data obtained using traditional methods (Bartneck, Duenser, Moltchanova, & Zawieska, 2015; Buhrmester, Kwang, & Gosling, 2011).

The way MTurk works is: a requester creates a Human Intelligence Task (HIT) where he or she specifies what needs to be done, duration of the task, criteria for the workers and a compensation amount. Mturk workers select HITs they wish to complete from the list of all available HITs. To complete an HIT, a worker must meet HIT criteria and accept the HIT by clicking on “Accept HIT” in MTurk. When HIT is completed, the worker receives a code that he or she needs to enter in order to be paid.

MTurk HIT created for this study asked participants to complete an on-line questionnaire. The MTurk HIT was titled “Psychology Study: General Attitudes and Behavior (approx. 15 min)” (see [Appendix 6](#)). To minimize self-selection bias, the task title was vague; ecological behavior, nature, and mindfulness were not mentioned in the task description. MTurk’s automatic qualification functionality was used to verify that the participants met the “approval rating” and “country of residence” criteria. Only verified participants were able to accept the task in MTurk and complete the questionnaires.

Verified MTurk workers were presented with a brief task description and an informed consent form (See Appendix 5). Participants were told that: the task involved answering questions about their general attitudes and behaviors; it would take about 15 minutes to complete; and upon consent, they would be given 3 hours to complete the study. They were also informed that the participation in the study is voluntary, anonymous, and that they could terminate their participation at any time. The task description also stated the compensation and the condition that compensation would only be rendered to the participants who answered all questions. Upon consent, participants were redirected to Qualtrics survey page from where they viewed and answer the questions.

MTurk protects users' privacy by prohibiting collection of personally identifiable information, such as name and e-mail address; thus, participants were identified and recorded using MTurk system-generated user identification numbers. No personally identifiable information, including names, date of birth, or personal identification numbers, was requested. The de-identified questionnaire data will be stored on the author's password protected hard drive for 5 years from the thesis publication date.

Data Cleaning

After the data collection had been completed, the data were downloaded from Qualtrics to the author's PC for analysis. Immediately after the download, the data was screened for duplicate IP address. After identifying and deleting duplicates, all IP addresses were destroyed in order to de-identify the data. Two participants (1.2%) were removed from the study because of duplicate IP address. Duplicate IP addresses can be an indication that the same person completed the same task twice. Additional data

screening revealed that nine participants (5.5%) did not answer all the questions (5.5%), three participants (1.8%) had either fake responses and/or completed the survey in less than 50.0% of median completion time of 483 seconds. Less than 4 minutes response time for 92 questions suggested that the participants did not read the questions carefully before answering them. Fake answers were identified when participants either provided the same answers to contradictory questions or had the same answer to all task questions. In addition, one participant was removed due to not meeting country of residence inclusion criteria.

Data Analysis

IBM SPSS version 24 statistical package for Windows was used to reverse negatively stated question scores, to calculate questionnaire mean scores, and to perform statistical data analysis. ACER ConQuest version 4 Rasch model software was used to calibrate GEB answers and to calculate GEB latent scores for each participant in logit form.

Each questionnaire (LMS, CSN, GEB) was scored according to the original authors' instructions. Scores were also calculated for each LMS subscale (Flexibility, Novelty Seeking, Novelty Producing and Engagement) and for each GEB behavior domain (Energy Conservation, Mobility and Transportation, Waste Avoidance, Recycling, Consumerism, Vicarious and Social Behaviors Toward Conservation). Cronbach's alpha was computed for each scale in order to check internal consistency using study data. After scores had been computed, descriptive statistics were calculated to check for data consistency and data outliers. Next, statistical data analysis was performed separately for each study aim.

Aim 1

Hierarchical multiple regression was used to test the primary hypotheses that sociocognitive mindfulness is a significant predictor of pro-environmental behavior (Hypothesis 1) and that sociocognitive mindfulness and connectedness with nature each provide unique prediction of pro-environmental behavior, and together collectively they predict pro-environmental behavior better than each of these predictors does alone (Hypothesis 3). A Pearson product-moment correlation coefficient was used to test for a positive relationship between sociocognitive mindfulness and connectedness with nature (Hypothesis 2).

Aim 2

Pearson product-moment correlation coefficients were used to test secondary study hypotheses, that Novelty Seeking LMS subscale has the strongest relationship with ESB (Hypotheses 4) while Engagement LMS subscale has the strongest relationship with connectedness to nature (Hypotheses 5).

Aim 3

Pearson product-moment correlation coefficients were used to investigate the relationships among General Ecological Behavior (GEB) domains, the Langer Mindfulness Scale (LMS) and its subscales, and the CNS to determine which combination of LMS subscales and GEB domains has the strongest correlation, and which of the four LMS subscale has the strongest correlation with CNS.

Aim 4

To assess sex differences in LMS, CNS, and GEB scores, a series of independent-sample *t*-tests were performed. Further, tests of statistical significance of the differences between Pearson product-moment correlation coefficients was conducted for each demographic group in order to determine whether the relationships among mindfulness, connectedness to nature, and ecological behavior differ with respect to age, race, marital status, employment status, education, and income.

Chapter III

Results

The final sample in this study consisted of 149 U.S. residents. The demographic characteristics of the sample are displayed in Table 1. Demographic data (Table 1) revealed that some demographic variables included only a few participants (e.g., for the education variable, there was only one person with a doctoral degree; for the income variable, there was only one person with an income of \$150,000 and above). Thus, these categories were combined into broader categories so that the data could be used for statistical analysis. Table 2 displays the combined (when necessary) demographic categories.

Ecological behavior, the main dependent variable, was estimated with the GEB (General Ecological Behavior) Scale. Because GEB is a Rasch scale, the responses were calibrated using Rasch scale specific software (ConQuest) according to the author's instructions (F. Kaiser, personal communication, November 8, 2016). Calibrating the current study data showed high item response theory-based reliability ($r = .81$) and good internal consistency (Cronbach's $\alpha = 0.76$) for the GEB Scale. Reliability of the independent variable measures was also tested using current study data. Both LMS and CNS subscales demonstrated good internal consistency (Cronbach's $\alpha = .94$ and Cronbach's $\alpha = .90$, respectively).

Table 1**Demographic Composition of the Study Sample**

Variables		Total	Female	Male
Sample size		149	81 (54.4%)	68 (44.6%)
Age	18 to 24 years	10 (6.7%)	3 (2.0%)	7 (4.7 %)
	25 to 34 years	49 (32.6%)	23 (15.4%)	26 (17.4%)
	35 to 44 years	35 (23.5%)	18 (12.1%)	17(11.4%)
	Age 44 or older	55 (36.9%)	37 (24.8%)	18 (12.1%)
Ethnicity	African American/Black	10 (6.7%)	8 (5.4%)	2 (1.3%)
	Arab	1 (0.7%)	1 (0.7%)	
	Asian/Pacific Islander	10 (6.7%)	2 (1.3%)	2 (1.3%)
	Hispanic	4 (2.7%)	1 (0.7%)	3 (2.0%)
	Indigenous or Aboriginal	1(0.7%)	1 (0.7%)	
	White/Caucasian	122 (88.9%)	69 (46.3%)	53 (35.6%)
	Would rather not say	1(0.7%)		1 (0.7%)
Marital Status	Married	59 (39.6%)	37 (24.8%)	22 (14.8%)
	Single/never married	55 (36.9%)	13 (8.7%)	5 (3.4%)
	Divorced	18 (12.1%)	19 (12.8%)	38 (24.2%)
	Living w/ partner	12 (8.01%)	8 (5.4%)	4 (2.7%)
	Widowed	3 (2.0%)	2 (1.3%)	1 (0.7%)
	Seperated	2 (1.3%)	2 (1.3%)	
Employment Status	A homemaker/on maternity leave	6 (4.0%)	5 (3.4%)	1 (0.7%)
	A student	8 (5.4%)	3 (2.0%)	5 (3.4%)
	Employed full-time	82 (55.0%)	40 (26.8%)	42 (28.2%)
	Employed part-time	15 (10.1%)	10 (6.7%)	5 (3.4%)
	Out of work and looking for work	3 (2,0 %)	2 (1.3%)	1 (0.7%)
	Retired	7 (4,7 %)	4 (2.7%)	3 (2.0%)
	Unable to work	4 (2.7%)	4 (2.7%)	
Education	Less than High School	2 (1.3%)	1 (0.7%)	1 (0.7%)
	High School / GED	14 (9.4%)	9 (6,0 %)	5 (3.4%)
	Some College	40 (27.0%)	19 (12.8%)	21(14.1%)
	2-year College Degree	14 (9.4%)	11 (7.4%)	3 (2,0 %)
	4-year College Degree	64 (43.0%)	34 (22.8%)	30 (20.1%)
	Masters Degree	9 (6,0 %)	5 (3,4 %)	4 (2.7%)
	Doctoral Degree	1 (0.7%)	1 (0.7%)	
	Professional Degree (JD/MD)	5 (3.4 %)	1 (0.7%)	4 (2.7%)
Income	\$0 - \$25,000	50 (33.6%)	30 (20.1%)	20 (13.4%)
	\$25,001 - \$50,000	54 (36.2%)	31(20.8 %)	23 (15.4%)
	\$50,001 - \$75,000	29 (18.5%)	14 (9.4%)	15 (10.1%)
	\$75,001 - \$100,000	9 (6.0%)	4 (2.7%)	5 (3.4%)
	\$100001 - \$125000	4 (2.7%)	2 (1.3%)	2 (1.3%)
	\$125,001 - \$150,000	2 (1.3%)		2 (1.3%)
	\$150001 +	1 (0.7%)		1 (0.7%)

Note: This table represents the demographic background of the study sample

Because Rasch scale software calculates best person estimate of ecological behavior in logit form, the personal GEB scores had to be converted to numeric format to be employed in multiple regression analyses. Thus, each respondent's GEB score was calculated by first converting polytomous responses into dichotomous responses according to the scale author's instructions and then by summing all the resulting values

for each participant. The resulting GEB sum scores were compared to the GEB logit scores using Pearson product-moment correlations. Because GEB sum scores were highly correlated with GEB logit scores, $r(147) = .97, p > .001$, it was concluded that the sum scores measure behavior as well as the logit scores and, thus, might be used for the hypothesis testing in the multiple regression model. The scores for LMS and its subscales and for CNS were calculated according to the original author instructions.

Table 2

Demographic Analysis Results

Variables		Total	Female	Male
Sample size		149	81 (54.4%)	68 (44.6%)
Ethnicity	White/Caucasian	122 (88.9%)	69 (85.2%)	53 (77.9%)
	Other	27 (11.1%)	12 (14.8)	15 (22.1%)
Marital Status	Single	78 (52.3%)	36(44.4%)	42 (61.8%)
	In a relationship	71 (47.7%)	45(55.6%)	26 (38.2%)
Employment Status	Employed full-time	82 (55.0 %)	40 (49.9%)	42 (61.8%)
	Employed part-time	15 (10.1%)	10 (12.3%)	5 (7.4%)
	Out of work	52 (34.9%)	31 (38.3%)	21 (30.9%)
Education	High School / GED or less	70 (47%)	40 (49.4%)	30 (44.1%)
	Some College, 2-year College 4-year college, Masters, Doctoral, Professional (JD/MD)	79(53.0 %)	41 (50.6%)	38 (55.9%)
Income	\$0 - \$25,000	50 (33.6%)	30 (37.0%)	20 (29.4%)
	\$25,001 - \$50,000	54 (36.2%)	31(38.3 %)	23 (33.8%)
	\$50,001 +	45 (29.2%)	20 (24.7%)	25 (36.8%)

Note: This table represents the demographic categories that had to be updated.

Further, preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity, and homoscedacity. Even though the predictor variables were correlated, $r(149) = .48, p < .001$, the relationship was much lower than the .9 multicolliniarity limit. Tolerance was .77, which is well above .10 acceptable levels. For residuals, Cook's Distance was .68, which is below 1, indicating no issues with residuals. Residuals' plot had no points outside of the acceptable range of

3.3 to 3.3. Inspection of the correlation table showed that both independent variables had correlations with the dependent variable above .3, with mindfulness, $r(147) = .40, p > .001$, and connectedness to nature, $r(147) = .49, p < .001$).

Table 3
Descriptive Statistics for The Study Variables

Variable	M (SD)	95% CI		Range	Skew	Kurtosis
		LL	UL			
GEB Score	19.5 (6.0)	18.57	20.51	8-36	0.32	-0.10
GEB Behavior categories						
<i>Energy Conservation</i>	6.2 (1.6)	5.9	6.5	2-9	-0.5	-0.5
<i>Mobility & Transportation</i>	2.6 (1.5)	2.3	2.8	0-8	0.7	0.9
<i>Waste Avoidance</i>	1.8 (1.2)	1.6	2.0	0-5	0.4	-0.3
<i>Consumerism</i>	4.1 (1.7)	3.8	4.4	0-8	0.3	-0.2
<i>Recycling</i>	2.5 (1.2)	2.3	2.7	0-4	-0.1	-1.4
<i>Vicarious/Social behaviors</i>	2.3 (1.8)	2.1	2.6	0-9	1.5	2.3
CNS Score	3.57 (0.77)	3.41	3.66	1.29-5	-0.44	-0.28
LMS Score	108.7 (20.6)	105.4	112.0	47-147	-0.8	0.6
LMS Subscales						
<i>Flexibility</i>	19.4 (4.3)	18.7	20.1	7-28	-0.8	0.8
<i>Novelty Seeking</i>	33.2 (6.9)	32.1	34.3	9-42	-1.1	1.3
<i>Novelty Producing</i>	28.8 (7.8)	27.5	30.0	8-42	-0.7	-0.0
<i>LMS Engagement</i>	27.4 (4.4)	26.7	28.1	16-35	-0.5	0.2

Note: CI = confidence interval; LL = lower limit, UL = upper limit; GEB = General Ecological Behavior; LMS = Langer Mindfulness Scale; CNS = Connectedness to nature; (n = 149).

Hierarchical multiple regression was calculated to predict ecological behavior based on mindfulness and connectedness with nature, while controlling for the demographic variables (see Model 1 in Table 4). Demographic variables were entered at Step 1 and MLS and CNS scores were entered at Step 2. The model as a whole explained

30% of the variance in ecological behavior, $R^2 = .30$, $F(10, 138) = 5.93$, $p < .001$. None of the demographic variables except for sex ($p < .05$) was statistically significant. However; both predictors in Step 2 (CSN score and LMS score) were statistically significant; they together collectively explained 25% of variance in ecologically sustainable behavior, after controlling for the demographic variables with the CNS recording a higher beta value (see Table 4) than the LMS.

In addition, a moderation effect of connectedness with nature on the relationship of mindfulness to ESB was tested by adding a moderator variable (a product of LMS and CNS Z-scores) to the regression model. The moderator variable was not significant ($p = .054$, n.s.). When tested with a similar hierarchical regression model, mindfulness as a single predictor in Step 2 accounted for 15.4% of variability in ecological behavior, after controlling for demographic variables, $\Delta R^2 = .15$, $F(7, 141) = 5.13$, $p < .001$ (Model 2 in Table 4); Connectedness with nature, as a single predictor in Step 2, accounted for 21.1% of variability in ecological behavior after controlling for demographic variables, $\Delta R^2 = .21$, $F(7, 141) = 7.078$, $p < .001$ (Model 3 in Table 4). To this point in the analysis, there appears to be support for the primary study hypotheses 1, 2 and 3.

The relationships between ecological behavior (as measured by the GEB) and the four LMS subscales (Flexibility, Novelty Seeking, Novelty Producing and Engagement) were tested using Pearson product-moment correlation coefficients. Preliminary analyses showed no violation of the assumptions of normality, linearity, and homoscedasticity. There was a moderate correlation between each of the four mindfulness subscales (see Table 5) and the GEB scores, with Novelty Seeking showing the strongest association with both ecological behavior, $r(147) = .40$, $p < .001$, and connectedness to nature,

$r(147) = .49, p < .001$. These findings provide support for hypothesis 4 but not for hypothesis 5.

Table 4

Hierarchical Multiple Regression Analysis Predicting Ecological Behavior from Mindfulness and Connectedness with Nature

Predictor	Ecological Behavior as Measured by GEB Scale					
	Model 1		Model 2		Model 3	
	ΔR^2	β	ΔR^2	β	ΔR^2	β
Step 1	.05		.05		.05	
Control variables ^a						
Sex ^b		.16*		.19*		.16*
Step 2	.25***		.15***		.21***	
LMS Score		0.23**		.40***		
CNS Score		0.37***				0.48***
Total R^2	.30***		.21***		.26***	
N	149		149		149	

Note. ^aControl variables included sex, age, race, marital status, education, income, and employment status.

^bThe table displays only control variables showing statistical significance ($p < .05$) in the regression model.

* $p < .05$. ** $p < .01$. *** $p < .001$

Further, Pearson product-moment correlation coefficients were used to examine relationships between six GEB behavior domains (Energy Conservation, Mobility and Transportation, Waste Avoidance, Consumerism, Recycling, and Vicarious and Social Behavior Toward Conservation), CNS, and MLS scale and its four subscales. The correlation coefficient values ranged from small to large and most were statistically significant (see Table 5). The analysis showed that LMS overall measure had the strongest positive correlation with the Vicarious and Social Behaviors Toward

Conservation domain of GEB, $r(147) = .37, p < .001$. The same GEB domain had the strongest positive correlation with CNS, $r(147) = .47, p < .001$ and with Novelty Seeking LMS subscale, $r(147) = .38, p < .001$.

Table 5

Summary of Pearson Product-Moment Intercorrelations for Scores on the LMS and its Subscales, CNS, GEB, and GEB Behavioral Domains

Measures	GEB	EC	M&T	WA	C	R	VSBC	CNS
LMS	.40**	.23**	.26**	.33**	.18*	.22**	.37**	.49**
CNS	.49**	.25**	.37**	.26**	.31**	.25**	.47**	--
LMS Subscales								
<i>Flexibility</i>	.38**	.28**	.27**	.26**	.19*	.20*	.30**	.38**
<i>Novelty Seeking</i>	.40**	.27**	.24**	.31**	.19*	.21**	.36**	.45**
<i>Novelty Producing</i>	.29**	.1	.19*	.30**	.13	.15	.30**	.44**
<i>Engagement</i>	.39**	.18*	.24**	.24**	.16	.24**	.30**	.39**

Note. LMS = Langer Mindfulness Scale; CNS = Connectedness to nature Scale; GEB = General Ecological Behavior Scale; GEB Subscales: EC = Energy Conservation, M&T=Mobility and Transportation, WA = Waste Avoidance, C = Consumerism, R = Recycling, BSBS = vicarious and social behavior toward conservation. The largest correlation values for each group and subgroup are in boldface.

Correlation is significant at the .01 level (2-tailed).**

Correlation is significant at the .05 level (2-tailed).*

Because the hierarchical multiple regression analysis described above showed that sex was a significant predictor of GEB, after controlling for other demographic variables (see Table 4), a between-sex analysis was performed to check for significant differences between males and females in regards to all three main research variables and their interrelationships. First, an independent-sample *t*-test was conducted to compare mindfulness (MLS), connectedness to nature (CNS), and general ecological behavior (GEB) scores for males and females. There was a significant effect for sex, with females

reporting more ecological behavior, $t(147) = -2.11, p = .037, d = 0.35, 95\%, CI [18.57, 20.51]$, and higher connectedness to nature scores, $t(147) = -2.42, p = .017, d = 0.40, 95\% CI [3.41, 3.66]$, than men. However, there were no significant sex differences in overall mindfulness scores ($p = .82, n.s.$). Figure 2 displays the significant mean differences.

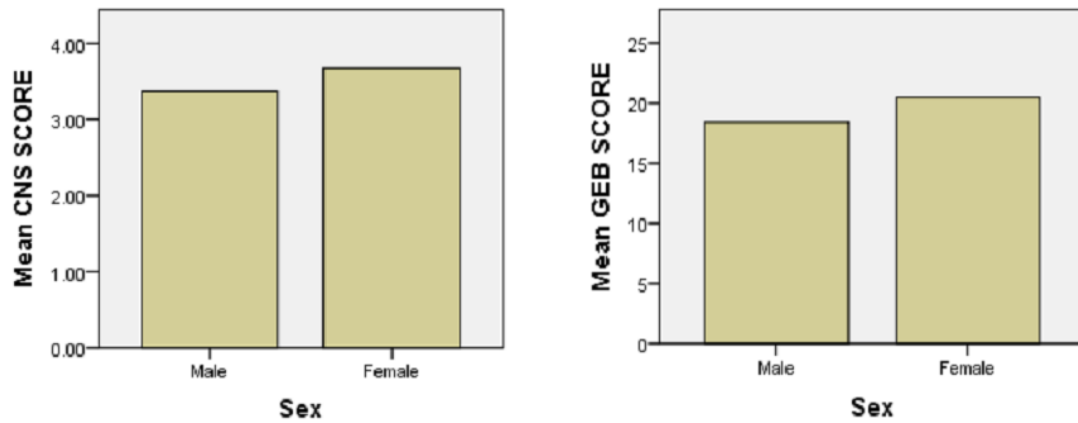


Figure 2. Mean GEB and CNS Scores. Between sex comparison of CNS and GEB scores. CNS = Connectedness to Nature Scale; GEB = The General Ecological Behavior Scale.

Second, multiple regression analyses were employed to predict ESB based on mindfulness and connectedness to nature scores separately for each sex group to check for sex differences in the relationships among the main study variables. The models explained 22% and 29% variance in ESB for males and females respectively; both models were statistically significant. For males: $F(2, 65) = 9.16, p < .001, R^2_{\text{Adjusted}} = .22$; for females, $F(2, 78) = 16.02, p < .001, R^2_{\text{Adjusted}} = .29$. Both Connectedness to Nature ($\beta = .36, p < .001$) and Mindfulness ($\beta = .26, p = 0.018$) were significant predictors of ESB for females; However for males, only CNS was a statistically significant predictor of ESB

($\beta = .36, p = 0.006$). The correlation between the two predictors was slightly higher among men, $r = .51, p < .001$, than it was among women $r = .51, p < .001$.

Third, I checked whether males and females scored differently on the six GEB subcategories. Three of six domains of ecological behavior showed statistically significant between-sex differences: Mobility and Transportation, $t(147) = -.043, p < .05, d = 0.36, 95\%, CI [2.30, 2.80]$, Consumerism, $t(147) = -2.125, p < .05, d = 0.36, 95\% CI [3.80, 4.40]$ and Vicarious Social Behavior Toward Conservation, $t(147) = -2.57, p < .01, d = 0.43, 95\%, CI [2.30, 2.70]$.

Next, I checked for demographic differences related to race/ethnicity, relationship status, education and income in the correlations among the main study variables. The analysis showed that all non-White races combined showed no significant correlation between CNS and GEB scores ($p = 0.92, n.s.$). This was the only demographic variable to show no significant relationships between the two main study variables. No other significant demographic differences in correlations between the main study variables have been observed (see Table 6).

Finally, demographic differences were explored in the relationships among LMS subscales, GEB scores and CNS scores. Table 6 below shows that among females, ecological behavior had the strongest association with Flexibility and among males, it had the strongest association with Novelty Seeking. For individuals with a lower level of education (less than 2 years of college), Novelty Seeking was most highly correlated with GEB, $r(77) = .38, p < .001$, while for people with higher education (4 years of college or more), it was Flexibility, $r(68) = .47, p < .001$. Similar income differences were observed. For those with lower income (\$50,000 or less annually), the strongest correlation was between Novelty Seeking and GEB score, while for those with higher income

(\$50,000+), Flexibility showed the highest correlation coefficient with GEB. Table 6 also shows that LMS Engagement and Novelty Producing had the weakest correlations with ecological behavior for all demographic groups.

Table 6

Pearson Product-Moment Correlation Between Predictor Variables and GEB as a Function of Sex, Ethnicity, Relationship Status, Education, and Income

Instruments	Sex		Ethnicity		Relationship Status		Education		Income		
	Male	Female	White	Other	Single	In a relationship	≤2 years of college	>4 years of college	<\$25,000	\$25,000 - \$49,000	>\$50,000
CNS	.45**	.49**	.52**	.33	.52**	.47**	.45**	.53**	.52**	.47**	.50**
LMS	.35**	.44**	.38**	.46**	.40**	.42**	.31**	.47**	.40**	.42**	.40**
LMS Subscales											
Flexibility	.40**	.38**	.37	.38**	.34*	.32*	.27*	.47**	.34*	.32*	.56**
Novelty Seeking	.31*	.47**	.40*	.39**	.47**	.43**	.38**	.43**	.47**	.43**	.31*
Novelty Producing	.26*	.33**	.28*	.39**	.25	.30*	.16	.41**	.25	.30*	.35*
Engagement	.27*	.38**	.32*	.43**	.36*	.41**	.26*	.41**	.36*	.41**	.24
n	68	81	122	27	78	71	79	70	50	54	45

Note: LMS = Langer Mindfulness Scale; CNS = Connectedness to nature Scale; GEB = General Ecological Behavior Scale. The largest correlation values for each demographic group are in boldface. Correlation is significant at the 0.01 level (2-tailed).** Correlation is significant at the 0.05 level (2-tailed).*

Chapter IV

Discussion

The purpose of this study was to investigate the relationships among sociocognitive mindfulness, subjective feeling of connectedness to nature and engagement in pro-environmental behavior in a sample of U.S. adults. The data provided initial support for the three primary hypotheses and one of two secondary hypotheses. The study found that mindfulness was a significant predictor of self-report ecologically sustainable behavior, and that it was moderately correlated with connectedness to nature construct—another significant predictor of ESB; Together, mindfulness and connectedness to nature predicted ESB better than each of these predictors did alone. In addition, exploratory data analysis showed that Vicarious Social Behaviors Toward Conservation GEB behavioral domain had the strongest association with both mindfulness and connectedness with nature. Finally, demographic data analysis pointed to sex differences in the relationships among the main study variables, while the other demographic variables showed no significant effect on these relationships.

Because earlier studies had demonstrated that Eastern tradition-based mindfulness is associated with both pro-environmental behavior (Amel et al., 2009; Barbaro & Pickett, 2015, Barber & Deale, 2014; Brown & Kasser, 2005, Ericson et al., 2014; Kaplan, 2010) and feeling of connectedness to the natural world (Hoot & Friedman, 2011; Mayer & Frantz, 2004; Nisbet & Zelenski, 2013; Wolsko & Lindberg, 2013), it was expected that similar associations would exist for Langer's sociocognitive mindfulness construct. The sociocognitive mindfulness associations found here are in line

with earlier findings about Eastern tradition mindfulness. For example, analysis of the current study data showed moderate correlations between LMS scores and both GEB and CNS scores. In a similar manner, Barbaro and Pickett (2015) also reported moderate to strong correlations between trait mindfulness and pro-environmental behavior and between trait mindfulness and CNS, also drawing participants from MTurk and using the CNS, although the measures of pro-environmental behavior were different. Current findings are in line with Amel et al.'s (2009) earlier research that investigated associations of *acting with awareness* and *observing* facets of Five-Facet Mindfulness Questionnaire (FFMQ) with pro-environmental behavior. The authors reported that only acting with awareness facet predicted pro-environmental behavior. Similarly to Langer's mindfulness (Langer, 1989), acting with awareness is concerned with attention to one's actions and habitual "autopilot" behaviors (Amel et al., 2009; Baer et al, 2006), whereas observing focuses on noticing internal sensations and emotions and does not overlap with Langer's mindfulness definition.

Although the present investigation demonstrated a moderate correlation between mindfulness and ESB, Brown and Kasser (2005) reported a small but significant correlation between meditation-based mindfulness and two different measures of pro-environmental behavior (ecological foot print, environmental behavior) but in a sample of members of a spiritual organization. Spiritually inclined people are found to be more environmental friendly than the public (Gifford & Nilsson, 2014; Jacob et al., 2009; Markowitz, Goldberg, Ashton, & Lee, 2012), this may be the reason why meditation mindfulness in Brown and Kasser (2005) showed weaker association with ESB than sociocognitive mindfulness did in this study. There may be other plausible explanations for the present findings. However, these require further investigation into what

characteristics (e.g., heightened attention and curiosity) different between mindfulness constructs that may explain the differences in the previous studies on mindfulness and pro-environmental behavior and the present investigation. Such research has the potential to shed light on what personal characteristics should be cultivated in future research aimed to foster ecological behavior.

Two earlier studies also reported weak or non-existent associations between mindfulness and connectedness to nature (Howell et al., 2011; Wolsko & Lindberg, 2103), whereas the current study showed a moderate correlation. These studies employed the Mindful Attention Awareness Scale (MAAS), which focuses on trait mindfulness measuring one's attentiveness to internal sensations and external stimuli in the present moment (Brown & Ryan, 2003). Thus, the operationalization of mindfulness in the MAAS has only a small overlap with Langer's construct of mindfulness when it comes to the state of "wakefulness" to one's environment and one's actions. However, unlike Brown and Warren's (2003) formulation, Langer's mindfulness construct emphasizes the individual's use of active cognitive processes to deal with input from the environment, and not just simply noticing it. Seeking novelty in one's environment and being aware of multiples perspectives are the examples of the cognitive processes suggested by Langer's mindfulness theory. These differences in the two mindfulness constructs and the differences in the study findings suggest that it may not be self-focused attention that leads to the feeling of unity with one's environment and ultimately to pro-environmental behavior but rather other aspects of mindfulness (e.g., perspective taking, attention to one's actions) that do so. As support for this latter notion, Shultz (2000) demonstrated that taking the perspective of an animal hurt from environmental pollution leads both to individuals' increased relatedness to nature and environmental concern.

As predicted, the results of this study demonstrate that both mindfulness and connectedness with nature each provided unique prediction of pro-environmental behavior, and that together collectively they predict pro-environmental behavior better than each of these predictors does alone. The only study to date that investigated the associations among three similar constructs reported that connectedness with nature mediated the relationship between mindfulness and pro-environmental behavior (Barbaro & Pickett, 2015). Because all relationships among the three variables in the current study were significant, some degree of mediation is possible. However, in contrast to Barbaro and Pickett (2015), this study does not suggest directions of the relationships among the three variables; but instead, it shows that mindfulness and connectedness with nature each provides unique predictions of ESB.

The relationship between mindfulness and connectedness with nature may be bi-directional. Chanowitz and Langer (1981) demonstrated that people process only personally relevant information in a conscious mindful way; thus, connectedness with nature may lead to curiosity about consequences of one's actions on the environment and to seeking information about new pro-environmental behavior alternatives. Both curiosity and information seeking are mindfulness qualities (Langer, 1992). Contradictory to the prediction that LMS engagement factor would have the strongest association with mindfulness, correlational analyses revealed that LMS Novelty Seeking showed the strongest correlation. All LMS subscales had moderate correlations with CNS scores. This finding supports the interpretation that it is individuals' cognitive operations acting on the environment, and not just the attentiveness aspect of mindfulness, which is associated with nature connectedness. That is, the intellectual curiosity associated with novelty seeking may lead to individuals acquiring knowledge and understanding that we

are part of an interconnected eco-system. It may also be that attending to a big picture (LMS Engagement factor) may lead to viewing oneself as part of our natural environment. Further, being aware of changes around us, another aspect of engagement, may lead one to notice how one's actions impact on the environment.

Further, correlation analysis of LMS subscales with GEB showed, as predicted, that Novelty Seeking had the highest correlation coefficient. Engagement and Flexibility were moderately correlated with GEB, whereas Novelty Producing was weakly correlated. These findings offer a potential explanation of how mindfulness may lead to pro-environmental behavior. That is, to select environmentally friendly options available to us, we must first learn that they exist and then be willing to select them from available alternatives. According to Langer's mindfulness theory, Novelty Seeking implies being curious, liking to investigate things and to acquire knowledge (Langer, 1989, 1992). These personal qualities may lead to both becoming aware of environmentally friendly options available to us and to what impact our actions have on our environment. In turn, such awareness leads to pro-environmental behavior (Frick et al., 2004; Gardner & Stern, 2008; Gleim et al., 2013; Marchand & Walker, 2008). Moreover, Langer suggests that the Flexibility factor concerns having an open mind and being open to new ways of doing things (Pirson, Langer, Bodner, & Zilcha, 2013). It is possible that when becoming aware of environmentally friendly alternatives, flexible people are more likely to choose them rather than acting out of habit. Thus, it is not surprising that Novelty Seeking and Flexibility demonstrated the strongest associations with GEB in the current study.

Examining the associations of the six GEB behavioral domains with mindfulness and connectedness with nature helped to identify ecological behavior categories most and least associated with the two predictor variables. It was revealed that only two of six GEB

domains—Vicarious and Social Behaviors Toward Conservation (VSBC) and Waste Avoidance (WA)— had moderate correlations with the LMS overall score. The remaining four domains were only weakly correlated with LMS (see Table 5). Correlations of LMS subscales with GEB domains (Table 5) were examined to help generate a potential explanation for why VSBC had the strongest association with LMS. However all four LMS subscales yielded a close moderate correlation with VSBC. Therefore, no conclusion could be made.

VSBC questions concern behaviors such as contributing financially to environmental organizations, boycotting companies with unecological backgrounds, and talking with friends about environmental issues. Connectedness to nature was also moderately and the most strongly correlated with VSBC. This finding is interesting insofar as other GEB domains include many environmental behaviors that might be performed for economical considerations (e.g., refraining from owning a car, keeping one's home at a low temperature during the winter). In contrast, VSBC includes behaviors without any such financial benefits. This observation strengthens the evidence toward a positive association between Mindfulness and ESB. Moreover, because CNS showed the largest correlation with VSBC, the study results confirm the assertion prevalent in the current literature that the feeling of connectedness with nature leads to less selfish attitudes toward the environment and to more environmental concern and behavior (Barbaro & Pickett, 2015; Mayer & Frantz, 2004; E. K. Nisbet et al., 2009; E. Nisbet, Zelenski, & Murphy, 2011; P. W. Schultz, 2000; P. P. Schultz, Ryan, Niemiec, Legate, & Williams, 2014).

Consumerism and Recycling GEB domains showed only weak relationships with LMS scores in the current study (Table 5). Jacob et al. (2006) reported similar results for

meditation-based mindfulness: there was a lack of significant relationships between recycling behaviors and mindfulness and only weak relationships between mindfulness and two other environmental behavioral measures comparable to Consumerism category of GEB. While LMS scores were only weakly correlated with Consumerism, CNS was moderately correlated. This might be because connectedness with nature has been associated with reduced materialistic values (Howell et al., 2011) and with increased environmental concern (Shultz, 2001). Socio-cognitive construct of mindfulness has not been reported to have such utility yet. CNS was also moderately correlated with Mobility and Transportation, while the remaining three GEB domains showed small correlations with CNS. Among other questions, the Mobility and Transportation domain includes outdoor activities questions, such as biking and walking. Because there is emerging empirical evidence that outdoor activities in the natural environment increase individuals' feelings of connectedness with it (Wolsko & Lindberg, 2013), it is possible that engaging in Mobility and Transportation domain behaviors that include outdoor activities may lead to more pro-environmental behavior.

All of the conclusions made from analysis of relationships among LMS scale and subscales scores, GEB domains, and CNS scores are interpretations requiring confirmation by replication studies and (field) experimental research. Nevertheless, this detailed analysis provides findings for future experimental research. For example, it can help both to identify domains of ecological behavior that are most likely to be induced with CN and with socio-cognitive mindfulness interventions. Moreover, it can assist in tailoring mindfulness interventions (e.g., novelty seeking activity vs. novelty producing) intended to foster different ecological behaviors.

For example, my colleagues at Langer's lab and I have begun a mindfulness intervention study to promote ecological behavior — use of cloth diapers. Participants are mothers with 3-5 months old babies who use exclusively disposable diapers. The participants were randomly assigned to one of three conditions: control, information, and mindfulness. After collecting demographic information and assessing participants on the LMS, all participants received one cloth reusable diaper by mail. All the participants had to acknowledge receipt of the diaper by email. Participants in the Control group did not receive either additional information or instructions. Participants in the Information group received information about environmental consequences of using disposable diapers and about the benefits of using cloth diapers. Participants in Mindfulness intervention group were asked to notice differences between the disposable diapers they have been using and the cloth diaper they received. According to Langer's mindfulness theory, comparing differences involves cognitive operation on the familiar stimuli and leads to mindfulness (Langer, 1989, 1992). The hypothesis is that people in the mindfulness intervention group would be more likely to switch to using cloth diapers (engage in ESB) than people in Control and Information groups. The data about subsequent use of cloth diapers have not been collected as of yet. However, during the initial phase of the study, only participants in the mindfulness group asked questions about the product and commented on its price, confirming their mindfulness state in the form of engagement with and active cognitive processing of the stimuli (new environmentally friendly product).

Because sex turned out to be the only significant predictor of ecological behavior of all the demographic variables employed in the regression model, it was important to examine between-sex differences in the main study variables and in the power of mindfulness, specifically the LMS, to predict ESB. In accordance with earlier studies on

sex differences in ESB (Vicente-Molina, Fernández-Sáinz, & Izagirre-Olaizola, 2013; Zelezny, Chua, & Aldrich, 2000) females scored significantly higher than males on the ESB scale employed here. Similarly, CNS scores were higher for females. This is important insofar as there is no definitive answer in the current literature as to why women score higher on ecological behavior measures than men; the mechanisms behind the discrepancies is unknown. Higher engagement in pro-environmental behavior among females could potentially be the result of having stronger emotional connection not only with interpersonal others but also with the natural environment. There were no significant differences in Mindfulness scores between males and females in the present study. However, sex differences were found when multiple regression was calculated separately for each group: mindfulness and connectedness with nature predicted less variability in ESB for males than they did for females. While both mindfulness and connectedness with nature were significant predictors of pro-environmental behavior for women, mindfulness was not a significant predictor for men. This could be because males showed stronger correlation between the two predictor variables than females. Further analysis is required to explain these between-sex differences in the influence of socio-cognitive mindfulness and connectedness with nature on pro-environmental behavior.

Even though the analysis of the remaining demographic variables (see Table 6) revealed no significant differences in relationships among the main study variables (mindfulness, connectedness with nature, pro-environmental behavior) for any other demographic groups, some potentially useful observations can be made. The Novelty Seeking LMS factor had the strongest correlation with GEB for the most demographic groups with some exceptions: that is, for males with a higher education and the highest

income. For these demographic groups flexibility LMS factor had the strongest correlation with ESB. These are possible reasons for the discrepancies.

First, men have been found to score higher on Openness to Experiences on Big 5 personality trait tasks (Schmitt, Realo, Voracek, & Allik, 2008), which is conceptually similar to the LMS Flexibility factor (Sternberg, 2000). Second, it is possible that people with higher education are more intellectually curious and, as a result, more knowledgeable about environmental issues and about environmentally friendly alternatives available to them than people with lower education. Because they may already have the awareness of their alternatives, people with higher education need Flexibility to act on their knowledge, while those with lower education need Novelty Seeking first to become aware of environmentally friendly alternatives and then to the alternatives' benefits to the environment. This may explain why Novelty Seeking had most utility for lower education participants and Flexibility had the most for higher education participants on ESB.

Third, higher income individuals are most probably those with higher level of education. That is why Flexibility had a greater effect on higher-level of education participants and Novelty seeking on lower-level education participants. Another explanation for the income group differences could be that high-income individuals can afford buying various products and services, while low-income individuals are limited by the choices available within their price range. Thus, high income individuals need to be open to try new environmentally friendly products and services (Flexibility), while people with low income need to find out what alternatives are available within their price range first (Novelty Seeking). This demographic variable analysis can add value to future

experimental research by designing different mindfulness interventions based on the demographic composition of a study sample.

Research Limitations

Despite the present study's significant findings, there are some limitations to the present research. Due to time and financial resources limits, only a small segment of the U.S. adult population ($N = 148$) completed the study questionnaire. Thus, this sample may not be representative of the population at large and the results may not generalize to the general public as a whole. The U.S. is a developed country with a high average household income. Study results may be different if the data are collected in developing countries with low average household income in which residents may be more likely to engage in sustainable behavior due to financial resources limitations rather than for sustainability. For example, people may reduce energy consumption and/or the use of public transportation because of the cost benefit; the behavior might not be associated with mindfulness or feelings of connectedness with nature.

For example, Vicente-Molina, Fernandez-Sainz, and Izagirre-Olaizola's (2013) analysis of pro-environmental behavior among students from countries with differing levels of economic development (USA, Spain, Mexico, Brazil) revealed important differences in the level of engagement in ESB in students from developing versus developed countries. Cultural differences have also been reported to influence ESB (Gifford & Nilsson, 2014) but these were not controlled for in this study. Thus, findings from the present investigation may not generalize to countries other than the USA. This research should be replicated with participants from other countries and with various cultural backgrounds.

Further, the sample employed here may not be representative of the population also because all participants are computer users who complete on-line assignments for a fee. Whitley (2009) argued that internet users who participate in this type of work are specific types of individuals. They are usually computer literate people with a relatively flexible schedule. Since MTurk prohibits the collection of participants' personally identifiable information, participants' identity and demographic information cannot be verified.

Another weakness of this research is that it only controlled for a limited number of demographic variables, and many demographic groups had very small representation. Thus, demographic differences results cannot be conclusive with the possible exception of the sex differences. For example, the results cannot be conclusive about racial/ethnic differences, because of 149 participants, 122 participants (89%) were White; the remaining races had to be combined in one category due to having only Non-white participants representing only 11% of the sample. Spiritual orientations as well as a higher level of education have also been associated with higher level of engagement in ESB (Gifford & Nilsson, 2014; Jacob et al., 2009; Markowitz et al., 2012). The study did not collect data about spiritual orientation and there was only a small number of participants with a yearly income above \$75,000 (10.7%) with only 30% of participants having incomes above \$50,000, which is just slightly above the U.S. median yearly income. Therefore, the findings concerning income differences are not conclusive because high-income individuals had very small representation.

Besides demographic characteristics, there are many social, personality and behavioral factors that influence engagement in ESB (Bamberg & Möser, 2007; Markowitz et al., 2012). For example, intrinsic values orientation (Hurst et al., 2013),

openness to new experiences personality trait (Markowitz et al., 2012) and behavioral intentions (Bamberg & Möser, 2007) are among many factors that have been implicated in the literature. However, the present study did not include and/or control for any of these significant predictors of ESB; future studies should take such variables into account.

The cross-sectional nature of the design presents an additional study weakness. Because data were collected at one time-point and some questions ask about subjective feelings that may change over time, such responses might be different if the data are collected at different time-points. Having a long questionnaire of 92 questions, including demographic information, is also a limitation. Participants could become bored during the task; as a result, they may not read all the questions carefully and may provide inaccurate responses. Another limitation of this study is in its utilizing only self-report measures of behavior. The direct measure of behavior instead of the self-reported measure is more valid because self-reporting may contain reporting and recall errors (Whitley, 2013).

Further, this study results may have limited comparability with earlier studies that investigated relationship between Easter traditions-based mindfulness with pro-environmental behavior because the current study used an ecological behavior measure (GEB) that was not used in the previous research with mindfulness. Repeating this study with previously used ecological behavior measures would allow for better comparison of predictive power of Langer's mindfulness to that of Eastern tradition mindfulness. Finally, neither the direction of the relationships between variables in this study nor causality between the variables can be established based on the study results; however, these conclusions will be possible to draw from experimental research for which this study provides a solid foundation.

Despite its limitations, the present study provides fundamental initial findings for developing experimental studies including field experimental ones to foster ecologically sustainable behavior. Consistent with previous research on Easter tradition-based mindfulness, this study provides initial support that both socio-cognitive mindfulness and connectedness with nature are positively associated with pro-environmental behavior.

These are important findings for future experimental research because both predictor variables employed in this research can be easily and effectively manipulated. Unlike other mindfulness constructs, a socio-cognitive mindfulness state can be achieved quickly and without regular meditation practice (Bishop et al., 2004). Moreover, subjective feeling of connectedness with nature can be increased through exposure to outdoor activities (Capaldi, Dopko, & Zelenski, 2014; Wolsko & Lindberg, 2103) and/or by asking people to take a different perspective (Shultz, 2001). Findings about what LMS subscales best predict ESB as well as what ESB types are most related to mindfulness and CN, can lead to creation of successful experimental research. In addition, being aware of demographic differences can help better to tailor mindfulness and CN interventions depending on the demographic composition of the study sample.

In conclusion, the present investigation makes an important contribution toward future research by presenting preliminary correlational data on the usefulness of examining socio-cognitive mindfulness and connectedness with nature for fostering pro-environmental behavior in the general public. Such relationships are clearly worthy of future empirical research.

Appendices

The appendices 1- 6 present supplementary information to the procedures used in this study. Appendices 1 to 4 contain instruments and questionnaires used to collect the study data.

Appendix 1

Demographic Questions

1. How old are you?

- ☐ Under 18 years (1)
- ☐ 18 to 24 years (2)
- ☐ 25 to 34 years (3)
- ☐ 35 to 44 years (4)
- ☐ Age 44 or older (5)

2. What is your current relationship status?

- ☐ Single, never married (1)
- ☐ Married (2)
- ☐ Living w/ partner (3)
- ☐ Divorced (4)
- ☐ Seperated (5)
- ☐ Widowed (6)

3. What is the highest level of education you have completed?

- ☐ Less than High School (1)
- ☐ High School / GED (2)
- ☐ Some College (3)
- ☐ 2-year College Degree (4)
- ☐ 4-year College Degree (5)
- ☐ Masters Degree (6)
- ☐ Doctoral Degree (7)
- ☐ Professional Degree (JD, MD) (8)

4. In which country do you reside?

☐ Please select from the list below... (1)

5. What is your ethnicity?

- ☐ Arab (1)
- ☐ White/Caucasian (2)
- ☐ African American/Black (3)
- ☐ Hispanic (4)
- ☐ Asian/Pacific Islander (5)
- ☐ Indigenous or Aboriginal (6)
- ☐ Pacific Islander (7)
- ☐ Would rather not say (8)
- ☐ Other (9)

6. What is your current employment status?

- ☐ Employed full-time (1)
- ☐ Employed part-time (2)
- ☐ Self-employed (3)
- ☐ Out of work and looking for work (4)
- ☐ Out for work but NOT currently looking for work (5)
- ☐ A homemaker/on maternity leave (6)
- ☐ A student (7)
- ☐ Military (8)
- ☐ Retired (9)
- ☐ Unable to work (10)

7. What is your annual salary (including bonuses and commissions) in U.S. dollars?

- ☐ \$0 - \$25,000 (1)
- ☐ \$25,001 - \$50,000 (2)
- ☐ \$50,001 - \$75,000 (3)
- ☐ \$75,001 - \$100,000 (4)
- ☐ \$100,001 - \$125,000 (5)
- ☐ \$125,001 - \$150,000 (6)
- ☐ \$150,001 + (7)

Appendix 2

Connectedness to Nature Scale (CNS)

Please answer each of these questions in terms of the way you generally feel. There are no right or wrong answers. Using the following scale, in the space provided next to each question simply state as honestly and candidly as you can what you are presently experiencing.

- | | 1 | 2 | 3 | 4 | 5 |
|---------|--|---|---------|---|-------------------|
| | Strongly
Disagree | | Neutral | | Strongly
Agree |
| ___ 1. | I often feel a sense of oneness with the natural world around me. | | | | |
| ___ 2. | I think of the natural world as a community to which I belong. | | | | |
| ___ 3. | I recognize and appreciate the intelligence of other living organisms. | | | | |
| ___ 4. | I often feel disconnected from nature. | | | | |
| ___ 5. | When I think of my life, I imagine myself to be part of a larger cyclical process of living. | | | | |
| ___ 6. | I often feel a kinship with animals and plants. | | | | |
| ___ 7. | I feel as though I belong to the Earth as equally as it belongs to me. | | | | |
| ___ 8. | I have a deep understanding of how my actions affect the natural world. | | | | |
| ___ 9. | I often feel part of the web of life. | | | | |
| ___ 10. | I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'. | | | | |
| ___ 11. | Like a tree can be part of a forest, I feel embedded within the broader natural world. | | | | |
| ___ 12. | When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature. | | | | |
| ___ 13. | I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees. | | | | |
| ___ 14. | My personal welfare is independent of the welfare of the natural world. | | | | |

Appendix 3

The General Ecological Behavior Scale (GEB)

1. For the following 32 behaviors, please indicate how often you perform them. Choose NA (not applicable) if you are unable to give an answer.

		Never	Seldom	Occa- sionally	Often	Always	NA
1	I ride a bicycle or take public transportation to work or school.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	I buy meat and produce with eco-labels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	I prefer to shower rather than to take a bath.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	<i>I buy beverages in cans.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	<i>I use an oven cleaning spray to clean my oven.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	I buy domestically grown wooden furniture.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	I wait until I have a full load before doing my laundry.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	<i>I drive my car in or into the city.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	<i>In the winter, I leave the windows open for long periods of time to let in fresh air.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	I wash dirty clothes without prewashing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	I drive on freeways at speeds under 100kph (= 62.5 mph).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	<i>For longer journeys (more than 6 hours), I take an airplane.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	<i>If I am offered a plastic bag in a store, I take it.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	In nearby areas (around 30 kilometers; around 20 miles), I use public transportation or ride a bike.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	I collect and recycle used paper.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	I bring empty bottles to a recycling bin.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	I have pointed out unecological behavior to someone.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	I contribute financially to environmental organizations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	I buy milk in returnable bottles.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	<i>I buy bleached and colored toilet paper.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	<i>I buy convenience foods.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	I buy products in refillable packages.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	I boycott companies with an unecological background.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	I buy seasonal produce.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	<i>I use a clothes dryer.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	I read about environmental issues.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	I talk with friends about problems related to the environment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

28	<i>I keep the engine running while waiting in front of a railroad crossing or in a traffic jam.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	<i>At red traffic lights, I keep the engine running.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	<i>I kill insects with a chemical insecticide.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31	In winter, I turn down the heat when I leave my apartment for more than 4 hours.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	<i>I drive to where I want to start my hikes.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. For the following 18 behaviors, please indicate whether you perform them or not. Choose the answer that fits your situation closest. Again, choose NA (not applicable) if you are unable to give an answer.

		Yes	No	NA
1	I reuse my shopping bags.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	<i>In the winter, I keep the heat on so that I do not have to wear a sweater.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	<i>I use fabric softener with my laundry.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	<i>I put dead batteries in the garbage.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	<i>After meals, I dispose of leftovers in the toilet.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	<i>I use a chemical air freshener in my bathroom.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	I am a member of an environmental organization.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	<i>In hotels, I have the towels changed daily.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	I own energy efficient household devices.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	After a picnic, I leave the place as clean as it was originally.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	I have purchased solar panels to produce energy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	I have looked into the pros and cons of having a private source of solar power.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	I am a vegetarian	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	I use renewable energy sources.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	I refrain from owning a car.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	I am a member of a carpool.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	I drive in such a way as to keep my fuel consumption as low as possible.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	I own a fuel-efficient automobile (more than 33 miles per gallon).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note. Items in italics indicate negatively formulated behaviors

Six domains of GEB

Energy conservation: 1.3, 1.7, 1.9, 1.10, 1.25, 1.31, 2.2, 2.8, 2.9, 2.11, 2.14

Mobility and Transportation: 1.1, 1.8, 1.11, 1.12, 1.14, 1.16, 1.17, 1.18, 1.28, 1.29, 1.32, 2.15

Waste Avoidance: 1.4, 1.13, 1.19, 1.22, 2.1

Consumerism: 1.2, 1.5, 1.6, 1.20, 1.21, 1.24, 1.30, 2.3, 2.6

Recycling: 1.15, 1.16, 2.4, 2.5

Vicarious: 1.17, 1.18, 1.23, 1.26, 1.27, 2.7, 2.10, 2.12, 2.13

Appendix 4

Informed Consent Form

Study Title: Mindfulness and pro-environmental behavior study
Researcher: Julia Andersen
Version Date: 09/27/2016

Participation is voluntary

It is your choice whether or not to participate in this research. If you choose to participate, you may change your mind and leave the study at any time. Refusal to participate or stopping your participation will involve no penalty or loss of benefits to which you are otherwise entitled.

What is the purpose of this research?

The purpose of this research is to investigate how different mindsets affect behavior.

How long will I take part in this research?

This research task takes approximately 15-20 minutes to complete.

What can I expect if I take part in this research?

As a participant, you will be asked to fill out on-line questionnaire that consists of demographics, mindset and behavior questions.

What are the risks and possible discomforts?

No risks are anticipated. However, if at any point you feel uncomfortable with any of the questions, you can stop completing this task. However compensation will only be awarded to participants who answered all the questions.

Are there any benefits from being in this research study?

None.

Will I be compensated for participating in this research?

Compensation in the amount of \$2 will be awarded to each participant upon answering all the questions. No partial compensation will be awarded for partially completed questionnaire.

If I take part in this research, how will my privacy be protected? What happens to the information you collect?

MTurk user ids will be automatically recorded and used to compensate the users who complete the task. You will not be asked to provide any other personally identifiable information. Participants IP addresses will not be recorded. Your responses will remain confidential. Once the responses are collected, and MTurk users are compensated, MTurk user ids will be deleted and the data will be de-identified. All the de-identified study data will be stored on the primary investigator's password protected hard drive for 5 years from the thesis approval date. Only the primary investigator and the members of the research team will have access to the study data.

If I have any questions, concerns or complaints about this research study, who can I talk to?

The researcher for this study is Julia Fedotova Andersen who can be reached at: +4792899797, jfedotova@fas.harvard.edu. The faculty sponsor is Dr. Ellen Langer, who can be reached at 617-495-3860, lander@wjh.harvard.edu.

If you have questions, concerns, or complaints,

- If you would like to talk to the research team,
- If you think the research has harmed you, or
- If you wish to withdraw from the study.

This research has been reviewed by the Committee on the Use of Human Subjects in Research at Harvard University. They can be reached at 617-496-2847, 1414 Massachusetts Avenue, Second Floor, Cambridge, MA 02138, or cuhs@fas.harvard.edu for any of the following:

- If your questions, concerns, or complaints are not being answered by the research team,
- If you cannot reach the research team,
- If you want to talk to someone besides the research team, or
- If you have questions about your rights as a research participant.

Statement of Consent

I have read the information in this consent form. All my questions about the research have been answered to my satisfaction. By clicking "Next" button I give my consent to participate in the study.

Appendix 5

Amazon's Mechanical Turk Human Intelligence Task Information:

Title: Psychology Study - General Attitudes and Behavior questionnaire.

Description: The questionnaire contains questions about your mindset, attitudes and behavior. You will also be asked to answer several demographic questions. No personally identifiable information other than your MTurk id will be collected.

Compensation: \$2

Time allotted per assignment: 3 hours

MTurk Workers Requirements:

- Fluent in English
- Participants approval rate over 95%
- US resident over 18 years or older

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